

## CLAIMS

What is claimed is:

1        1. A method for searching an audio database for a target audio clip in a  
2        multiprocessor system, comprising:  
3            partitioning said audio database into a plurality of groups;  
4            establishing a model for said target audio clip;  
5            dynamically scheduling said plurality of groups to a plurality of processors  
6        in said multiprocessor system; and  
7            processing said scheduled groups in parallel by said plurality of  
8        processors to search for said target audio clip.

1        2. The method of claim 1, wherein partitioning said audio database  
2        comprises determining a size for each of said plurality of groups, said size being  
3        determined to reduce the amount of overlapped computation among said  
4        plurality of groups and load imbalance in parallel processing of said plurality of  
5        groups.

1        3. The method of claim 1, wherein establishing a model for said target  
2        audio clip comprises extracting a feature vector sequence from said target audio  
3        clip and modeling said feature vector sequence based on a Gaussian Mixture  
4        model ("GMM"), said GMM including a plurality of Gaussian components.

1       4. The method of claim 3, wherein modeling said feature vector sequence  
2   comprises estimating mixture weights for each of said plurality of Gaussian  
3   components.

1       5. The method of claim 1, wherein processing said scheduled groups in  
2   parallel comprises:  
3       partitioning each of said scheduled groups into at least one segment; and  
4       for each segment,  
5           extracting a feature vector sequence for the segment, and  
6           modeling said feature vector sequence based on a Gaussian  
7       Mixture model ("GMM"), said GMM including a plurality of Gaussian  
8       components.

1       6. The method of claim 5, wherein each of said at least one segment has  
2   the same length in time as that of said target audio clip.

1       7. The method of claim 5, wherein if there are more than one segments in  
2   an audio stream, each segment partially overlaps with a segment that  
3   immediately precedes that segment.

1       8. The method of claim 5, wherein said plurality of Gaussian components  
2   are common for different segments and said target audio clip.

1        9. The method of claim 8, wherein modeling said feature vector sequence  
2        comprises estimating mixture weights for each of said plurality of Gaussian  
3        components.

1        10. The method of claim 9, further comprising: for each segment,  
2        computing a Kullback-Leibler ("KL") distance between a GMM of said  
3        segment and a GMM of said target audio clip; and  
4        determining that said segment matches said target audio clip, if said KL  
5        distance is smaller than a pre-determined threshold.

1        11. The method of claim 10, further comprising skipping processing a  
2        number of segments if said KL distance is larger than a predetermined value,  
3        said number of segments dependent on the value of said KL distance.

1        12. The method of claim 1, wherein said multiprocessor system  
2        comprises a memory shared by said plurality of processors.

1        13. An apparatus for searching an audio database for a target audio clip  
2        in a multiprocessor system, comprising:  
3        a partitioning module to partition said audio database into a plurality of  
4        groups;  
5        a scheduler to dynamically schedule said plurality of groups to a plurality  
6        of processors in said multiprocessor system; and

7       an audio searching module for each of said plurality of processors to  
8   process said scheduled groups in parallel by said plurality of processors to  
9   search for said target audio clip.

1       14. The apparatus of claim 13, wherein said partitioning module further  
2   determines a size for each of said plurality of groups, said size being determined  
3   to reduce the amount of overlapped computation among said plurality of groups  
4   and load imbalance in parallel processing of said plurality of groups.

1       15. The apparatus of claim 13, wherein an audio searching module  
2   comprises:  
3       a feature extractor to partition an input audio stream into at least one  
4   segment and to extract a feature vector sequence from each of said at least one  
5   segment, said at least one segment having the same length in time as that of  
6   said target audio clip; and  
7       a modeling module to model said feature vector sequence for each  
8   segment based on a Gaussian Mixture model ("GMM"), said GMM including a  
9   plurality of Gaussian components, said plurality of Gaussian components being  
10   common among all of the segments.

1       16. The apparatus of claim 15, wherein one of audio searching modules  
2   further process said target audio clip by extracting a feature vector sequence  
3   from said target audio clip and by modeling said feature vector sequence using

4 said GMM, said GMM including a plurality of Gaussian components common for  
5 said target audio clip and segments of said input audio stream.

1 17. The apparatus of claim 16, wherein an audio searching module  
2 further comprising a decision maker to compute a Kullback-Leibler ("KL")  
3 distance between a GMM of a segment of said input audio stream and a GMM of  
4 said target audio clip; and to determine whether said segment matches said  
5 target audio clip based on said KL distance.

1 18. The apparatus of claim 17, wherein said decision module further  
2 determines how many segments are to be skipped from processing based on  
3 said KL distance.

1 19. An article comprising a machine-readable medium that contains  
2 instructions, which when executed by a processing platform, cause said  
3 processing platform to perform operations comprising:  
4 partitioning said audio database into a plurality of groups;  
5 establishing a model for said target audio clip;  
6 dynamically scheduling said plurality of groups to a plurality of processors  
7 in said multiprocessor system; and  
8 processing said scheduled groups in parallel by said plurality of  
9 processors to search for said target audio clip.

1        20. The article of claim 19, wherein partitioning said audio database  
2        comprises determining a size for each of said plurality of groups, said size being  
3        determined to reduce the amount of overlapped computation among said  
4        plurality of groups and load imbalance in parallel processing of said plurality of  
5        groups.

1        21. The article of claim 19, wherein establishing a model for said target  
2        audio clip comprises extracting a feature vector sequence from said target audio  
3        clip and modeling said feature vector sequence based on a Gaussian Mixture  
4        model ("GMM"), said GMM including a plurality of Gaussian components.

1        22. The article of claim 21, wherein modeling said feature vector  
2        sequence comprises estimating mixture weights for each of said plurality of  
3        Gaussian components.

1        23. The article of claim 19, wherein processing said scheduled groups in  
2        parallel comprises:  
3            partitioning each of said scheduled groups into at least one segment; and  
4            for each segment,  
5                extracting a feature vector sequence for the segment, and  
6                modeling said feature vector sequence based on a Gaussian  
7                Mixture model ("GMM"), said GMM including a plurality of Gaussian  
8                components.

1        24. The article of claim 22, wherein each of said at least one segment  
2        has the same length in time as that of said target audio clip.

1        25. The article of claim 22, wherein if there are more than one segments  
2        in an audio stream, each segment partially overlaps with a segment that  
3        immediately precedes that segment.

1        26. The article of claim 22, wherein said plurality of Gaussian components  
2        are common for different segments and said target audio clip.

1        27. The article of claim 26, wherein modeling said feature vector  
2        sequence comprises estimating mixture weights for each of said plurality of  
3        Gaussian components.

1        28. The article of claim 27, wherein said operations further comprise: for  
2        each segment,  
3            computing a Kullback-Leibler ("KL") distance between a GMM of said  
4        segment and a GMM of said target audio clip; and  
5            determining that said segment matches said target audio clip, if said KL  
6        distance is smaller than a pre-determined threshold.

1        29. The article of claim 28, wherein said operations further comprise  
2        skipping processing a number of segments if said KL distance is larger than a  
3        predetermined value, said number of segments dependent on the value of said  
4        KL distance.

1        30. The article of claim 19, wherein said multiprocessor system  
2        comprises a memory shared by said plurality of processors.